

WHAT IS CLAIMED IS:

Sub B1

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A block polymer comprising:

- i) one or more cationic group-containing units; and
- ii) optionally one or more additional building block units;

provided that the block polymer has an average cationic charge density of about 15 or less.

Sub C2

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comprises:

2.

The block polymer according to Claim 1 wherein said block polymer further

- iii) one or more units having one or more hydroxyl groups, provided that said polymer has a Hydroxyl Group Density of about 0.5 or less.

15

comprises:

3.

The block polymer according to Claim 1 wherein said block polymer further

- iv) one or more units having one or more hydrophobe groups selected from the group consisting of non-hydroxyl groups, non-cationic groups, non-anionic groups, non-carbonyl groups, and/or non-H-bonding groups.

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Sub D1
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4.

The block polymer according to Claim 2 wherein said block polymer has a Hydroxyl Group Density of from about 0.0001 to about 0.4.

Sub C3

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5.

The block polymer according to Claim 1, wherein said polymer further comprises:

- v) units capable of having an anionic charge at a pH of from about 4 to about 12;
- vi) units capable of having an anionic charge and a cationic charge at a pH of from about 4 to about 12;
- vii) units having no charge at a pH of from about 4 to about 12; and
- viii) mixtures of units (v), (vi), (vii), and (viii).

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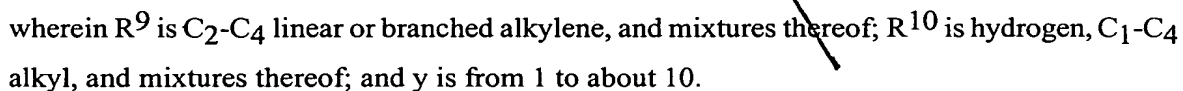
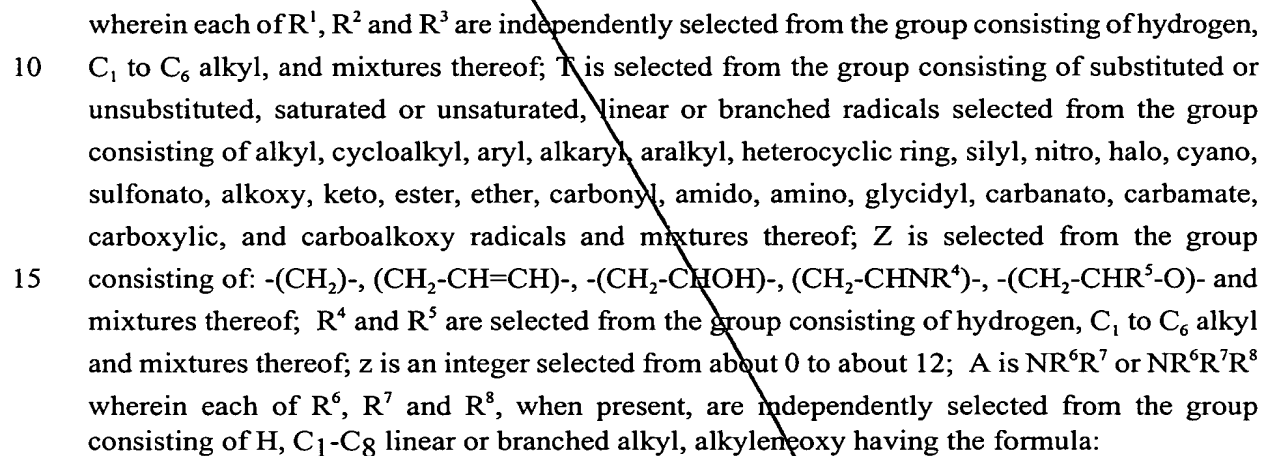
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The block polymer according to Claim 5, wherein said polymer average cationic charge density ranges from about 0.05 to about 5 units per 100 daltons molecular weight at a pH of about 4 to about 12.

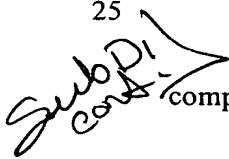
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8. The block polymer according to Claim 1, wherein said block polymer comprises a
5 cationic unit of the formula:

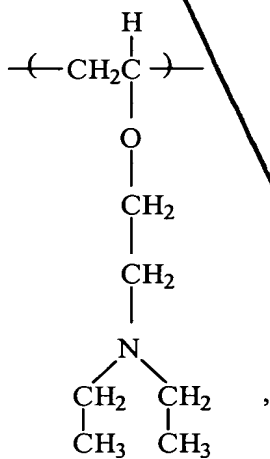
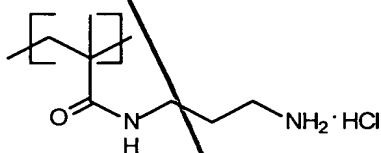
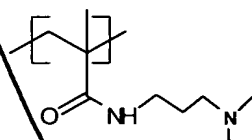
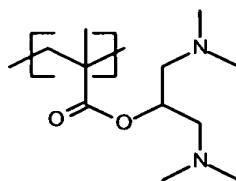


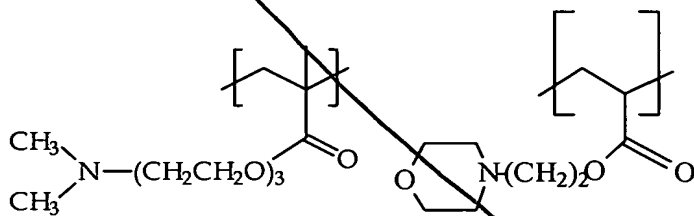
9. The block polymer according to Claim 1, wherein said block polymer comprises a cationic unit of the formula selected from the group consisting of:



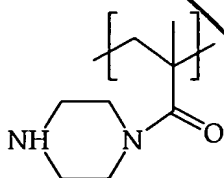
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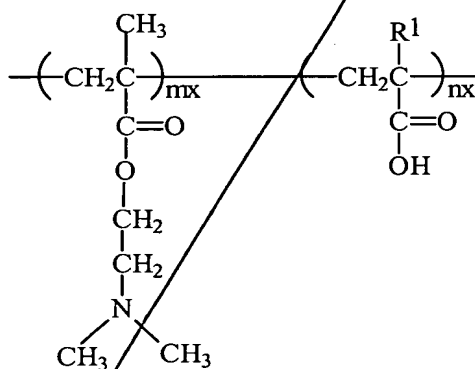
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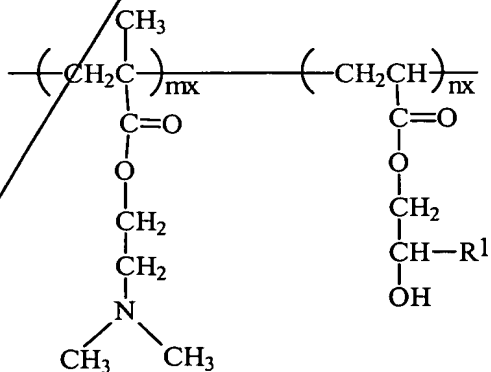
10. The block polymer according to Claim 1 wherein the block polymer is selected from the group consisting of:

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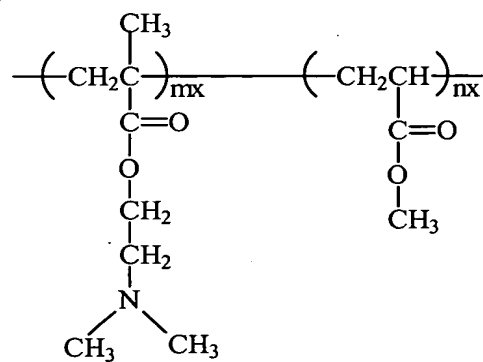
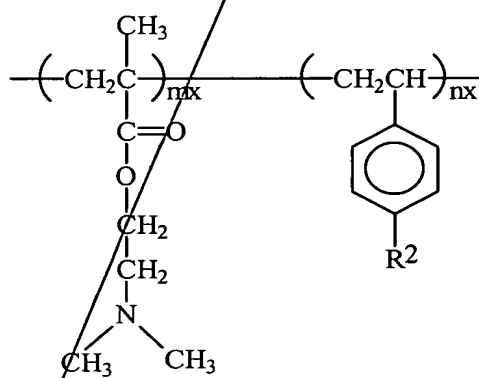
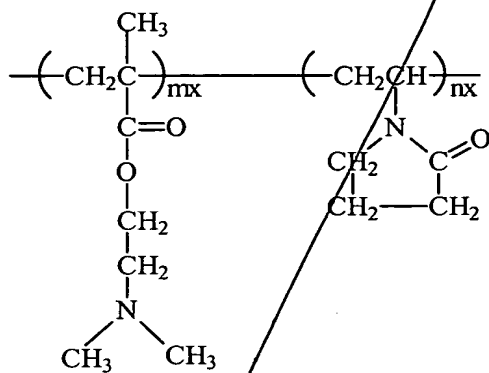
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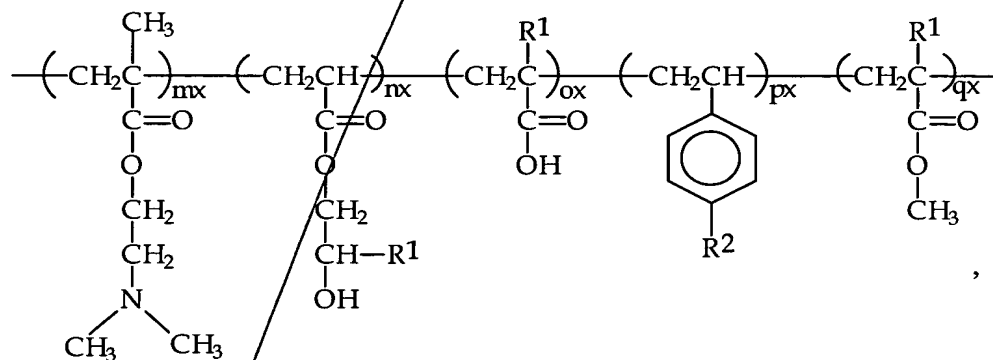
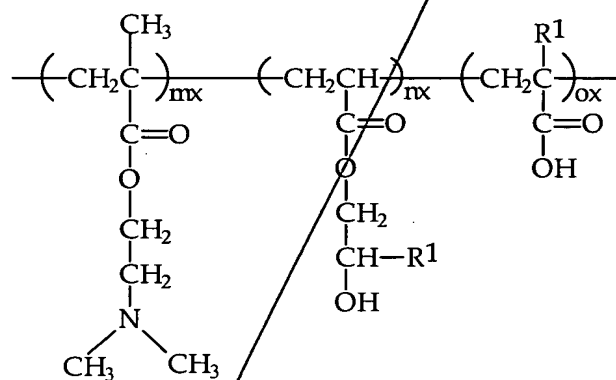
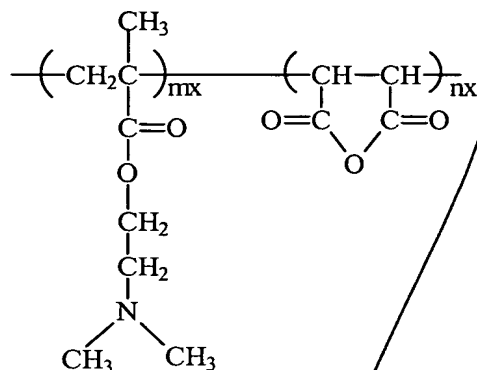
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wherein R¹ is selected from H and CH₃; R² is selected from H and SO₃H; x represents the total number of monomer units within the block polymer; m, n, o, p, q when present, represent the mole ratio of their respective monomeric units in a given block polymer where at least two different monomeric units are present in the block polymer.

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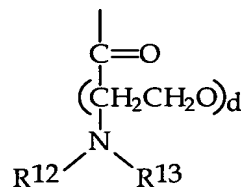
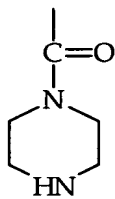
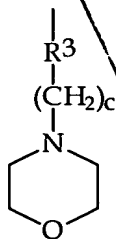
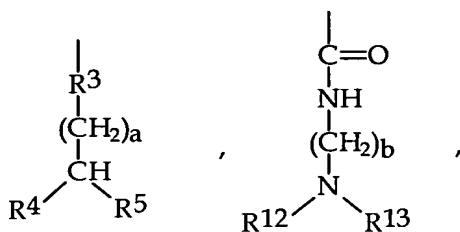


wherein R¹ is H or an alkyl having 1 to 10 carbon atoms,

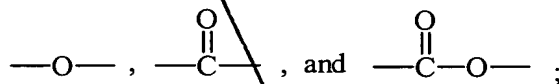
Sub B3
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R² is a moiety selected from the group consisting of

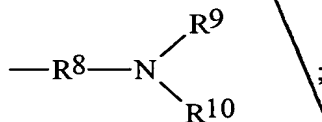


wherein R³ is selected from the group consisting of



a is an integer from 0 to 16; b is an integer from 2 to 10; c is an integer from 2 to 10; d is an integer from 1 to 100;

R⁴ and R⁵ are independently selected from the group consisting of -H, and



R⁸ is independently selected from the group consisting of a bond and an alkylene having 1 to 18 carbon atoms;

R⁹ and R¹⁰ are independently selected from the group consisting of -H, alkyl having 1 to 10 carbon atoms;

R¹² and R¹³ are independently selected from the group consisting of H and alkyl having from 1 to 10 carbon atoms;

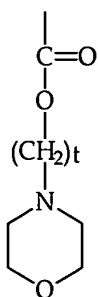
1. The first part of the report, which is the most important, is the one that deals with the results of the study. This part is divided into two main sections: the first section deals with the results of the study, and the second section deals with the conclusions of the study.

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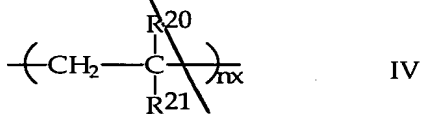
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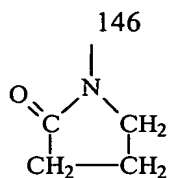
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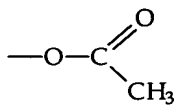
B. said monomeric unit B is selected from the group consisting of:
a monomeric unit of Formula IV

O=C1NCCCOC1

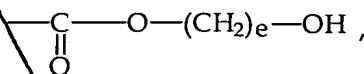
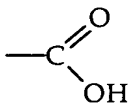
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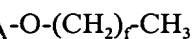


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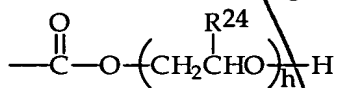
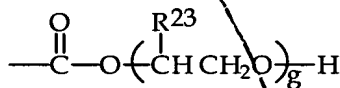
wherein e is an integer from 3 to 25;

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wherein f is an integer from 0 to 25;

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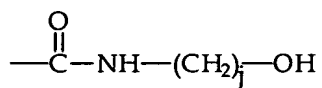
wherein g is an integer from 1 to 100,

h is an integer from 1 to 100,

R²³ is -H, -CH₃ or -C₂H₅,

R²⁴ is -CH₃ or -C₂H₅;

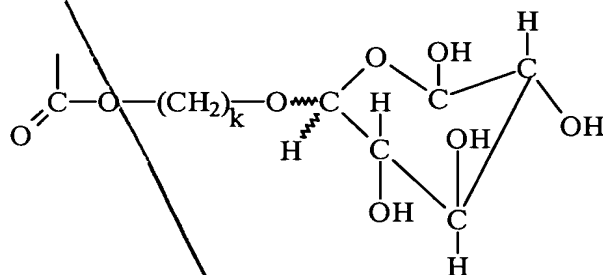
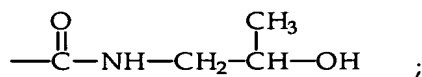
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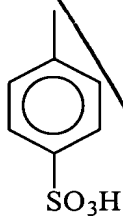
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wherein j is an integer from 1 to 25;

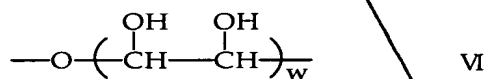


wherein k is an integer from 1 to 25;



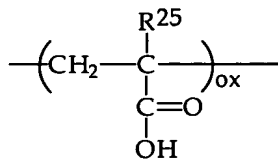
$\text{---NH---(CH}_2\text{)}_r\text{---NH}_2\text{---HCl}$, wherein r is an integer from 1 to 25; and

a polyhydroxy monomeric unit of Formula VI:



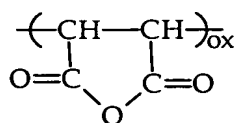
wherein w is an integer from 1 to 50; and

C. monomeric unit C is selected from the group consisting of:

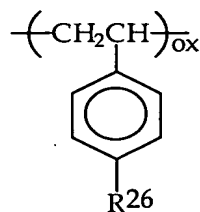


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wherein R^{25} is -H or $-CH_3$,



and



wherein R^{26} is -H or CH_3 , and

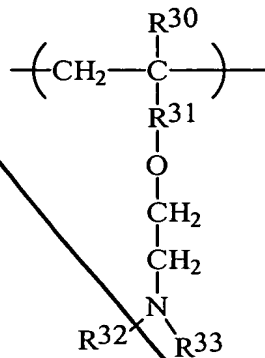
x represents the total number of monomeric units within the block polymer; m, n, o, when present, represent the mole ratio of their respective monomeric units in a given block polymer, wherein at least two different monomeric units are present in the block polymer.

13. The block polymer of Claim 12, wherein m is greater than 1, n is greater than 1 and o is greater than 1.

14. The block polymer of Claim 12, wherein said polymer comprises at least one said monomeric unit A, at least one said monomeric unit B and at least one said monomeric unit C.

15. The block polymer of Claim 12, wherein said at least one monomeric unit A is selected from the group consisting of:

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wherein R^{30} is H or ---CH_3 ,

wherein R^{31} is a bond or $\text{---}\overset{\text{O}}{\parallel}{\text{C}}\text{---}$, and

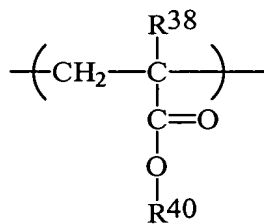
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R^{32} and R^{33} are ---CH_3 or $\text{---C}_2\text{H}_5$.

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16. The polymer of Claim 15, wherein said polymer is a terpolymer, said at least one monomeric unit B is selected from the group consisting of:

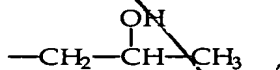
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wherein R^{38} is selected from the group consisting of H and CH_3 and

R^{40} is selected from the group consisting of $\text{---CH}_2\text{CH}_2\text{---OH}$ and

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and isomers thereof,

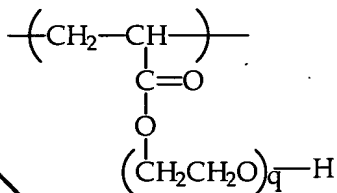
said terpolymer comprising said at least one monomeric unit C,

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wherein the molar ratio of said monomeric unit A : monomeric unit B : monomeric unit C is 1 to 9 : 1 to 9 : 1 to 6 respectively.

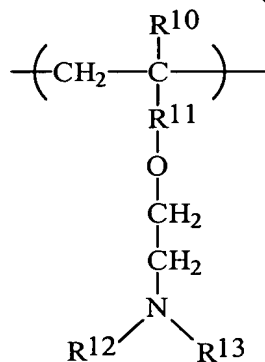
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17. The block polymer of Claim 12, wherein the at least one monomeric unit B has the formula:



wherein q ranges from 1 to 12.

18. The block polymer of Claim 17, wherein the polymer is a terpolymer, said at least one monomeric unit A is selected from the group consisting of:

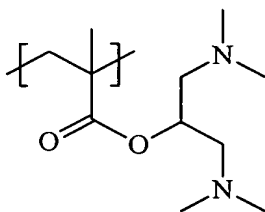


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cont¹ wherein R¹⁰ is H or CH₃,

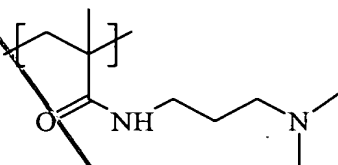
R¹¹ is a bond or $\text{—}\overset{\text{O}}{\parallel}\text{—}$, and R¹² and R¹³ are —CH_3 or $\text{—C}_2\text{H}_5$, and said monomer comprises said at least one monomeric unit C.

Sub B5⁵ 19. The polymer of Claim 18, wherein the molar ratio of monomeric unit A : monomeric unit B : monomeric unit C ranges from 1 to 9 : 1 to 9 : 1 to 3 respectively.

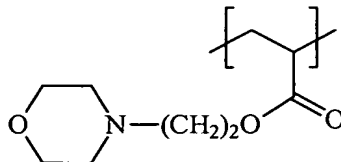
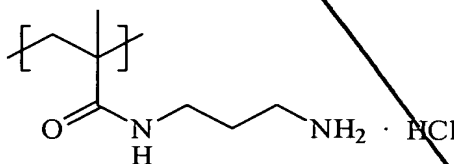
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cont¹⁰ 20. The block polymer of Claim 12, wherein said at least one monomeric unit A has a formula selected from the group consisting of:



and



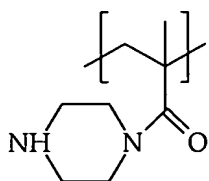
21. The block polymer of Claim 12, wherein said at least one monomeric unit B has a formula selected from the group consisting of:



and

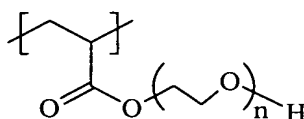
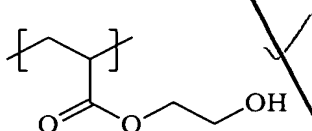
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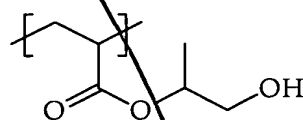
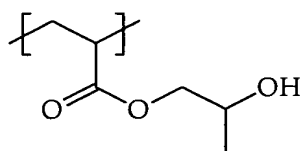
22. The block polymer of Claim 12, wherein said at least one monomeric unit B is selected from the group consisting of:

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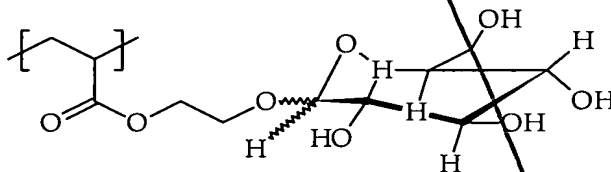


wherein n is an integer from 1 to 50, preferably 2 to 30, more preferably 7 to 27,

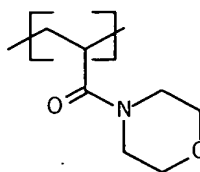
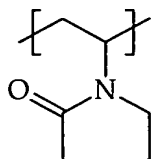
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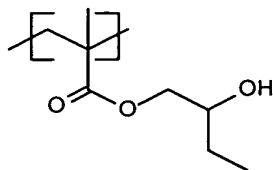
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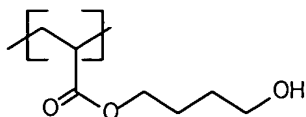
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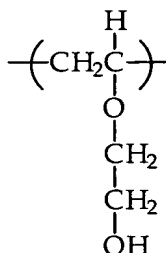
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23. The block polymer of Claim 12, selected from the group consisting of:
 poly(HEA-co-DMAM-co-AA) terpolymer, ✓
 poly(HPA-co-DMAM-co-AA) terpolymer, and
 poly(PEG-acrylate-co-DMAM-co-AA) terpolymer.

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24. The polymer of Claim 12, selected from the group consisting of:
 poly(HEA-co-DMAM) copolymer, poly(DMAM-co-butylvinylether) copolymer
 and poly(2-diethylaminoethylvinyl ether-co-ethyleneglycol monovinyl ether).

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25. A method for cleaning hair or skin comprising applying an effective amount of a
 cleaning composition comprising the polymer of Claim 1 and at least one deterative surfactant to
 hair or skin in need of cleaning, provided that a 10% aqueous solution of said composition has a
 pH from about 4 to about 9.

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26. The method of Claim 25, wherein said composition further comprises at least one
 member of the group consisting of a pearlizing agent, a silicone hair conditioning agent, and an
 antidandruff ingredient.

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27. The method of Claim 26, wherein said composition comprises:
- a) said pearlizing agent
 - b) a nonionic surfactant
 - c) an amphoteric surfactant
 - 5 d) a glycol emulsifier
 - e) water.

28. The method of Claim 26, wherein said composition comprises at least one amphoteric surfactant and said amphoteric surfactant comprises at least one member of the group
- 10 consisting of:

the alkali salts of alkyl amphodipropionates, alkyl amphodiacetates, alkyl amphoglycinates, alkyl amphopropyl sulfonates and alkyl amphopropionates wherein alkyl represents an alkyl group having 6 to 20 carbon atoms.

29. The method of Claim 28, wherein in said at least one amphoteric surfactant the alkyl group is derived from coconut oil or is a lauryl group.
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30. A method for cleaning hair or skin comprising applying an effective amount of a cleaning composition comprising the polymer of Claim 13 and at least one surfactant to hair or
- 20 skin in need of cleaning.

31. A composition for cleaning hair or skin comprising:
- the block polymer of Claim 1,
- at least one deterative surfactant, and at least one member of the group consisting
- 25 of a pearlizing agent, a silicone hair conditioning agent, and an antidandruff ingredient, provided that a 10% aqueous solution of said composition has a pH from about 4 to about 12.

32. A composition for cleaning hair or skin comprising:
- the block polymer of Claim 12,
- 30 at least one surfactant, and at least one member of the group consisting of a pearlizing agent, a silicone hair conditioning agent, and an antidandruff ingredient.

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33. The composition of Claim 32, wherein said silicone compound is an alpha, omega-trimethylsilyl-polydimethylsiloxane having a viscosity at 25°C of at least 25 centistokes and less than 60,000 centistokes.

5 34. A method for washing a fabric article in a washing medium comprising:
applying an effective amount of a laundry cleaning composition comprising the
polymer of Claim 1 and at least one detergent surfactant to a fabric article in need of cleaning.

10 35. The method of Claim 34, wherein said composition washes a colored fabric
article.

15 36. The method of Claim 34, wherein said composition comprises at least one
member of the group consisting of an aminosilicone, a Gemini surfactant, a detergency builder, a
bleach, an activator for percompound bleach, a soil suspending agent, a soil antiredeposition
agent, a foam suppressant agent and a fabric softener.

20 37. The method of Claim 34, wherein said composition comprises a foam suppressant
agent.

25 38. A method for washing a fabric article in a washing medium comprising:
applying an effective amount of a laundry cleaning composition the polymer of
Claim 13 and at least one detergent surfactant to a fabric article in need of cleaning.

30 39. A composition for washing a fabric article comprising:
the polymer of Claim 1;
at least one detergent surfactant; and
at least one member of the group consisting of an aminosilicone, a Gemini
surfactant, a detergency builder, a bleach, an activator for percompound bleach, a soil suspending
agent, a soil antiredeposition agent, a foam suppressant agent and a fabric softener.

40. A method for extinguishing fire comprising applying a foam to a fire, wherein the
foam comprises a foaming agent and a polymer of Claim 1.

Sub D1
cont. → 41. A method for treating at least one agricultural substrate selected from the group consisting of plants, seeds and soil comprising,

5 applying to the substrate a foam comprising at least one agricultural chemical selected from the group consisting of a herbicide, a pesticide, and a fungicide, a foaming agent and a polymer of Claim 1.

10 42. A method comprising, injecting into a subterranean formation, a foam comprising a foaming agent and a polymer of Claim 1.

43. A method comprising shaving hair from skin comprising applying foam shaving cream to the skin, said shaving cream comprising a foaming agent and a polymer of Claim 1.

15 44. A method comprising shaving hair from skin comprising applying a shaving gel to the skin, said gel comprising a foaming agent and a polymer of Claim 1.

45. A method for removing hair from skin comprising applying a depilatory foam to skin, said foam comprising a foaming agent and a block polymer of Claim 1.

20 46. A method of cleaning hard bathroom surfaces comprising applying to said surfaces a foam cleaner comprising a foaming agent and a polymer of Claim 1.

25 47. A process for making paper comprising aiding retention of titanium dioxide on the paper during the paper making comprising treating the paper with an aqueous solution comprising titanium dioxide and a polymer of Claim 1.